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Vol. XIII.

JANUARY, 1907

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No. 4.

THE AGRICULTURAL STUDENT



CHEMISTRY IN AGRICULTURE—EDWARD J. PETRY.

A GLIMPSE AT SOUTHERN AGRICULTURE—
HOMER C. PRICE.

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NITROGEN IN THE SOIL—M. D. MOORE.

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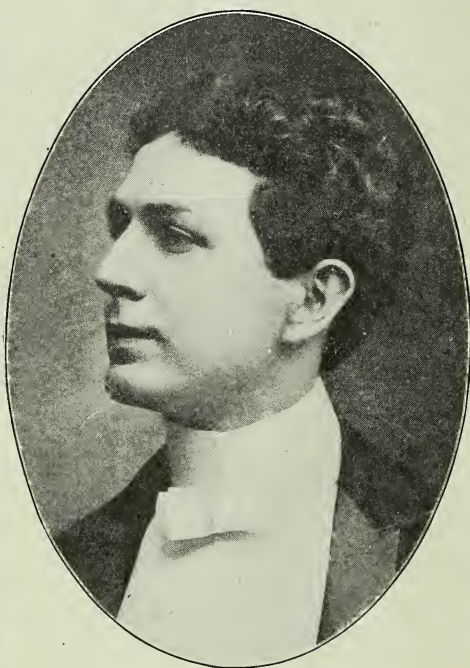
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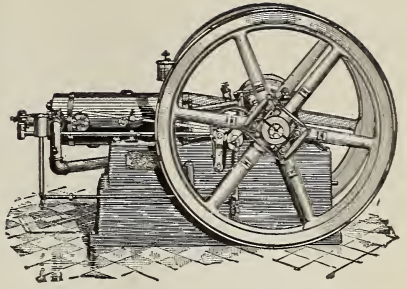
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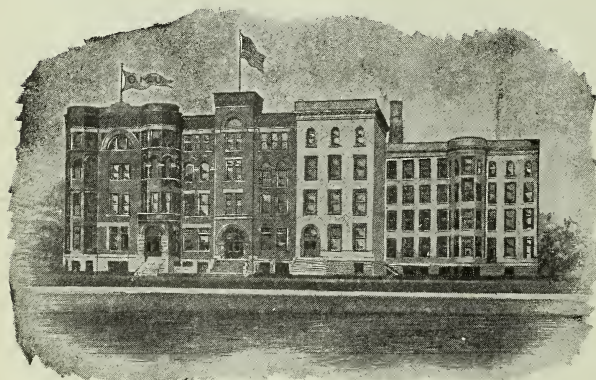
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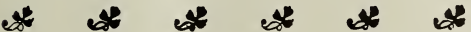
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EDITORIAL NOTES

The year of 1906 has closed, leaving a good record for crop production all over the land. The International Live-stock Show was the best ever, indicating that the products of the farm has been well used toward the production of high grade stock.

The meeting of American Federation of Agricultural Students was held in Chicago during the International. This is an annual affair, the object of which is to bring the students from the various agricultural colleges in closer touch, to become better acquainted. This year it was attended by one hundred and thirty students. A banquet was carried out to the satisfaction of all, after which followed a program of toasts from students of the different colleges.

We wish to say, by way of explanation, that the arrangement of last month's issue was due to an error on the part of the printer.

Winners at International.

Ontario and Iowa held the honors of the students' judging contest at the International Livestock Show of 1906. Ontario won the bronze bull trophy given for the best judging in cattle, sheep and swine, and Iowa the bronze horse prize for the best horse judging.

Ohio State stood third in the general average of colleges in the horse-judging work and also in the cattle, sheep and swine-judging. Professor Plumb says of the Ohio team: "Notwithstanding that the Ohio State team did not win a trophy at Chicago, the members of the team made a very creditable showing and they reflected credit on the university from every point of view. There were thirty-one men in the contest from different colleges, and of the ten who scored, the largest total number of points, three were from O. S. U."

The Ohio horse team was made up of Gerlaugh, McNutt, Williams, Crabb and White, and the same men composed the cattle team, with the exception of White, who was replaced by McBeth.

Twelve classes were judged, three each of horses, cattle, sheep and swine, 50 per cent. in each class being allotted to the placing and 50 per cent. to the reasons given for the placing. It is said that the Ohio team put up the best arguments for their placings of any of the six teams competing.

Four classes of four animals each were brought into the ring at a time for the contestants to work on. Those first brought in were four Percheron horses, four Hampshire hogs, four Short-horn heifers and four Lincoln sheep. Fifteen minutes were allowed the contestants for placing the animals and writing down such notes as they wished

to assist them in remembering the class. In the horse classes twenty minutes were allowed, in order to admit the moving of the animals. After the allotted time was up the animals were taken from the ring and each contestant went before the jurors, of which there were three for each class of animals, and gave his reasons for placing the animals as he did. Three minutes were given for this oral examination of the contestant by the judges, the former not being allowed to hold any paper or card of any kind.

The jurors had previously looked over the animals in each class and as the contestants gave his reasons he was given his rating according to the placing of the jurors.

The final scorings of the contest are appended.

Rank of students in horse-judging contest:

1. R. E. Drennan, Iowa..... 289
2. B. W. Crossley, Iowa..... 284
3. John C. McNutt, Ohio..... 281
4. J. B. McMillan, Iowa..... 273
5. A. H. Homer, Ontario..... 271
6. A. C. Burns, Texas..... 269
7. W. W. White, Texas..... 267
8. Howard Gerlaugh, O..... 266
9. Ellis Rail, Iowa 265
10. Geo. A. Crabb, Ohio..... 260

Possible mark, 300.

Rank of students in cattle, sheep and swine classes in stock-judging contest:

1. C. C. Nixon, Ontario..... 740
2. W. J. Hartman, Ontario... 725½
3. J. O. Olsen, Kansas..... 720
4. A. H. Homer, Ontario..... 709
5. John O. Williams, Ohio... 694
6. J. B. McMillan, Iowa..... 687
- 7 and 8. Ellis Rail, Iowa..... 676
- 7 and 8. W. W. Gemert, Kas. 676
9. Howard Gerlaugh, Ohio... 666
10. R. S. Hudson, Mich..... 665½

Rank of students in horses, cattle, sheep and swine at students' judging contest:

1. A. H. Homer, Ontario..... 980
2. J. O. Olsen, Kansas..... 975
3. C. C. Nixon, Ontario..... 972
4. W. J. Hartman, Ontario... 961½
5. J. B. McMillan, Iowa..... 960
6. Ellis Rail, Iowa 941
7. John C. McNutt, Ohio..... 940
8. R. A. Drennan, Iowa..... 935
9. Howard Gerlaugh, Ohio ... 932
10. John O. Williams, Ohio.... 930

Possible mark, 1000.

Although Ohio State's team did not win first place in the contest the live stock exhibited by the university was of an unusually high grade and in the various classes in which entries were made carried off many valuable prizes. The following list of prizes won will bear out this statement:

First prize on Berkshire barrow under six months.

First and second prize on Berkshire barrow over twelve months.

Second prize on pen of three Berkshire barrows under six months; champion Berkshire barrow.

Second prize on Poland China barrow between six and twelve months.

Second prize on pen of three Poland China barrows between six and twelve months.

Second prize barrow in the college class—The Clay, Robinson & Co. special.

First prize junior yearling, pure bred Shorthorn steer, won by Baron.

Second prize pure bred, 2-year-old Angus steer, won by Forest Mill Jot.

Second prize 2-year-old Hereford special, won by Ohio Gladiator.

Third prize 2-year-old Hereford special, won by Black's Ohio Champion.

Second prize yearling grade, won by Ohio's Sultan.

First prize 2-year-old Galloway steer,

won by Roger of Brookside, and was later made the champion Galloway steer of the show.

Second prize was also won in the steer carcass 2-year-old class by Ohio Lad.

The above prize, together with special prizes won by the university, makes the total winnings amount to about \$500.

The first-prize Galloway calf was purchased for the university. The university also recently purchased an Angus bull from Dr. H. M. Brown, of Hillsboro, Ohio.

Chemistry in Agriculture

As a human industry, agriculture ranks first, and it would seem that an occupation of such importance would lead all others in the application of science to its various operations, processes and methods. How completely this has been done can only be ascertained by facts, figures and close observation.

Since agriculture deals so intimately with matter and natural forces, and since chemistry, as a science, deals most largely with these two factors, it is inevitable that the latter will, in a very real way, promote the former. It shall be our endeavor to see how this aid comes about; how well it is utilized and whether more intensive application would further the productive capacity of this noble occupation.

In considering the relations between chemistry and agriculture, it is not sufficient to view only such phases as soil and conservation of fertility. Others of equal importance, like food products, their composition, disposition and by-products; and further protection against fraud in their production are considerations of an intensely chemical nature, and can not be well understood.

without some knowledge of this science.

The soil, its origin and properties, first demand our attention. This variously colored and textured, porous medium so well known to us, has not been thoroughly understood by even the leading investigators, until rather recently, and it is difficult to say how long it will be before a majority of our agriculturists come to a reasonable conception of its simpler laws.

If we go back to its origin we shall find a great mass of purely chemical, physical, and biological facts which explain the formation of soil better than any myth, alchemic theory or philosophic scheme ever could, for we will come to know that it is formed of definite compounds of the simpler elements like oxygen, silicon, calcium and iron, and that its texture, porosity and fertility are directly due to the chemical nature and amounts of these compounds, influenced by such other agencies as heat and cold, water and ice and plants and animals. To put it in another way: If one does not understand the chemical reasons for and desirability of light, friable and well drained soil, he is in a poor position to take the best advantage of circumstances—he is just that much in the dark.

Conservation of soil fertility, while closely connected with its origin, has today the distinct feature of artificial co-operation, i. e., the origin of a soil, explains why it can maintain itself, as regards fertility, while growing a forest, copse or prairie; but when annual and complete removal of its vegetable produce takes place, this secondary item—conservation or artificial maintenance of plant food—comes to be of first importance.

Without going into the chemical demonstration of how much and what compounds are necessary in this pro-

cess, it will be well to mention the fact that ultimately some plant foods must be brought from other sources than the farm itself, and it is here that chemistry lends a helping hand. Were it not for this science, millions of hard-earned dollars would be paid for fertilizing substances which would yield no returns; it would not stop here; confidence in this important expedient would soon be lost, while robbing the soil would continue. Even the proper conservation of the naturally produced fertilizers of the farm was not considered of any consequence, and untold millions were lost before chemistry awakened agriculturists to the fact. The only regret in this connection lies in the fact that a too small percentage of farmers is at present applying this knowledge fully. One may waste the profits of a year's work in either the purchase of next year's fertilizer or in the handling of this year's manure heap. Either chemical knowledge or analysis is the only sure preventative of this loss.

Food products, either coming to or leaving the farm, are the product of the farmers' exertions and it is important that they have standard quality, e. g., if one buys ten tons of chop feed, it would be a much safer transaction to know about how much fat, protein, ash and fibre he is buying. Some feeders will hardly believe that some feeds are not worth two-thirds of what they cost on the market.

To reverse the example: No one would care to sell a 5 per cent. (fat) milk, at the price that most people get for a 3 per cent. milk, nor would he be willing to sell a 35 per cent. (fat) cheese at the rate at which others sell a 20 per cent. (fat) grade of this product of the farm. However, this leads

into protection against fraud in competition, which will be viewed later.

The different plants and their specialization come up for chemical assay. This is the surest method of progress in plant breeding. We can never forget the example of the specialization of the sugar beet in Germany by chemical selection; in short, it is a great achievement to raise the sugar content of one plant from about 5 per cent. to 18 or 20 per cent.; and it may be possible to change the various valuable constituents of corn and other farm plants in a like degree; it would mean, moreover, a close grading of products so that a rational selling price for each variety would be maintained.

This phase of chemical data would further aid in the farmer's decisions as to which variety of corn or other produce he should sell and which one he should keep for secondary profit in feeding these plants to animals.

The matter of by-products need be considered only cursorily, though it is by no means unimportant. The skim-milk should not contain too much butter fat, nor should it be left to sour, and the proper handling of this by-product alone, from a chemical standpoint, will be a source of much profit.

Straw, cornstalks, ashes and many others will generally come under the head of conservation of soil fertility—there is a right and a wrong way of disposing of them.

Lastly but not least comes the matter of protection against fraud, as involved in the farmer's dealings with other occupations, as well as with the competition of rivals of his on other farms in other states and nations, for the farmer's market of today is influenced by many and various parts of the earth. He needs protection and some standards; in short, a square

deal. Foodstuffs, fertilizers, feeds, medicines and general supplies of inferior qualities, to say nothing of adulterated goods, are often sold. State and national laws have been in force for years, and yet this is no absolute guarantee of purity in these necessities of life; so there remains but one certain alternative—chemical analysis. Local adulteration of farm produce is, in many cases, unobserved by food authorities. This gives the farmer a doubly poor chance. Fancy an excellently constructed engine's running full capacity if the fuel is poor and with lubrication omitted; and yet equally prejudicial effects are seen in a large number of cases where the pure foods of the farm are mingled with the sophistication of the village or city grocer, and where these are eaten they impair a man's ability to labor. This aspect, as well as that of impure drugs, is not particularly confined to agriculture; therefore, further notice is here unnecessary.

There is a virtue in competition, especially when it involves true personal and national wealth, but is this ever to exist without standards of fairness? Standards of purity and their interpretations are the proper functions of chemistry, and they are as important and valuable in agriculture as they can well be. They are not only a determining factor in showing how a man's energies can be most economically used, but they are a direct factor in the amount of energy made available for production. This may appear mercenary, but the writer believes that capacities for energy are indices of health and that, to recoin an old interrogation, what profiteth it a man if he gain the whole world and lose his health and soul, is but to reiterate a modern truth in which the development of his

higher faculties are recognized as being most highly promoted in the best of health.

Finally, a word about chemical successes, appreciation and extension to agriculture may not be amiss. The government records are replete with achievements in the affairs of the soil, of crop improvements and of justice in competition, to say nothing of protection against poisonous, fraudulent adulterations. Despite these, it is a fact that the labors of this science are very poorly appreciated, as is indicated in the small amount of work authorized by law. While there would be due reason for complaint against the importance here given to chemistry in agriculture, it is hoped that the matters of long preparation and difficulty of the work, will, by competitive principles, finally settle the difficulty of chemists' salaries. This, however, does not settle the question uppermost in mind.

Thorough appreciation of chemical assay will only appear when the actual amount of this work done throughout the state will have increased many fold over that accomplished at present and that for agricultural purposes alone a corps of several trained persons, representing chemistry completely in every four or five counties would astonish the states if results were to be compared with those of the present overworked and handicapped experiment stations and food commissions.

Until this amount of chemical work is authorized by statute, till we know what materials we are handling and until we can really calculate our profits, satisfaction and health accurately, we cannot say that chemistry is doing all for agriculture that it is reasonably capable of doing.

EDWARD J. PETRY.

An Important Gift to the Ohio Agricultural College.

A letter dated November 23, addressed to Mr. Charles C. Glenn, secretary of the Percheron Registry Company, Columbus, Ohio, from Charles Aveline, president of the Percheron Horse Society of France, contains the important information that this society has unanimously voted to offer the Department of Animal Husbandry of the Ohio State University an object of art, represented by a Percheron horse. This trophy, for that is what it will be, will probably be a bronze figure of a Percheron. This is to be competed for annually among the students taking instruction in horse-judging at the university, the one showing the greatest proficiency having his name inscribed on the base of the trophy.

When visiting America in 1904, Mr. Aveline spent some time at Columbus, Ohio, the guest of McLaughlin Bros. He was aware that Ohio had, for over a half-century, been an important Percheron center, with great importing firms and that the breed at present is predominant in the state. Through Mr. J. B. McLaughlin, an old Ohio State University student, Mr. Aveline became interested in the active work of the university in promoting educational work regarding the horse, and this gift is in recognition of that effort. This was a very graceful and generous act of the Percheron society of France and the gift is much appreciated by both faculty and students. The trophy will serve as an inspiration to the classes in the years to come.



OSCAR BRADFUTE AND "LUCY'S PRINCE"

Lucy's Prince is probably the most famous aged bull in America today, having carried away grand championship honors at the International, and moreover being a remarkable breeder. He is a worthy representative of the modern type of beef animal, the type toward

which all modern breeders are striving, and which Mr. Bradfute has already achieved.

Mr. Bradfute has gained a wide reputation as an Angus breeder and his stables are replete with excellent specimens of this popular breed.

A Glimpse of Southern Agriculture.

The impressions that a stranger may get from a few days spent in traveling through a country that is new to him, and especially when the sight-seeing is mostly done from a moving railway train, at best can be only superficial.

My glimpse of Southern agriculture was gained from a recent visit to Baton Rouge, La., to attend the annual convention of American Agricultural Colleges and Experiment Stations. The trip from Columbus, Ohio, to New Orleans was made by the B. & O. Southwestern and the Illinois Central railroads and lay through Kentucky, Tennessee, Mississippi and Louisiana.

Starting at Columbus, there is a gradual change from the agriculture of Central Ohio with its principal crops—corn, wheat and hay and large number of live stock—to the agriculture of the South, with cotton practically the only crop raised and only enough live stock kept to do the work on the farms. Horses are replaced by mules; the use of oxen becomes common; and the negro replaces the white man as laborer in the field.

In contrasting Southern agriculture with the agriculture of the North, one is first impressed with the fact that the principal crops are entirely different; instead of corn, wheat and oats we have cotton, sugarcane and rice; our luxuriant bluegrass pastures are replaced by less thrifty Southern grasses. In the second place, one is impressed with the immense agricultural possibilities of the South, and the fact that the agriculture of the country is only in its infancy and that the agricultural resources of the country are undeveloped. The Mississippi valley, made up of the cream of the soil of the American continent, represents the most fer-

tile land to be found in the United States. Scarcely any of this land seems to be producing to its full capacity and it is only awaiting more intelligent management and intensive cultivation to yield many times what it is now producing.

Southern agriculture, from the standpoint of the farm home, stands in marked contrast to what is found in the North. The small farm managed and operated by the farmer and his family, with the possible assistance of one or two hired men, is replaced by the plantation, embracing hundreds of acres, and, in some cases, thousands of acres, on which practically all of the manual labor is done by negroes. The improvements on the land, under the plantation system, are inferior to the improvements on medium sized farms in the North. The milder climate of the Southern States also requires less shelter than is necessary in the North, and, for this reason also, the buildings and improvements are inferior to those found on Northern farms.

The two crops, which my trip gave me an opportunity to observe, were cotton and sugarcane. The cotton fields begin in Central Kentucky and extend to the Gulf of Mexico. The cotton crop is the money crop of the South and as it is usually grown, represents a low type of agriculture. It is grown in a haphazard way, poorly cultivated and poorly harvested. At present, a large part of the crop is still to harvest and the fields are white with cotton waiting to be picked. The cotton pickers, as seen from the train, are invariably colored, and men, women and children are to be seen working in the fields. When the cotton is picked, it is taken to the cotton gins, which separate the seed from the fibre and about one-half of the cotton, by weight,

as picked in the fields, consists of seed. These seed, which were formerly wasted, are now as carefully preserved as the fibre itself. The oil is expressed from them, producing the cottonseed oil, and the residue is ground for stock feed and large quantities of it exported or shipped to the North to be fed on the live stock farms. The fibre, after it is separated from the seed at the gins, is pressed into bales of four or five hundred pounds and are then ready to go on the market. One of the familiar sights at every railway station are the bales of cotton waiting to be shipped to market. The cotton crop of the United States in recent years has varied from eleven to thirteen million pounds, and the indications this year are that the crop will be one of the largest ever produced.

Sugarcane is a local crop, the bulk of it being grown in Louisiana, from which the state has derived its name of "Sugar Bowl." In the recent statistics of the United States Department of Agriculture, only two states are reported as producing cane sugar, and those are Louisiana and Texas, the former producing 325,000 tons and the latter producing 12,000 tons.

Sugarcane production impressed me as a high type of agriculture and representative of intensive farming. The lands devoted to sugarcane growing are the most fertile of the Mississippi valley and the men who operate them are the most intelligent class of farmers in the South. Before the establishment of the Federal Agricultural Experiment Station in Louisiana, the Sugar Planters' Association had established a private experiment station. The planters are just in the midst of harvesting their crop, and although, to the Northern man the following sounds

like an immense yield, it is reported to be a poor crop.

An average acre of cane will produce twenty-five tons of cane, stripped and topped ready for the factory, and at a factory we visited, the cane this year is producing 170 pounds of raw sugar to a ton of cane. Where cane is sold to factories, they are paying \$4 per ton for it. The common rotation followed on the sugar plantations is cane for two years in succession and the third year the ground is planted to corn and cow peas.

The cost of growing cane is so great that it must be carefully managed or it cannot be produced at all. An acre of cane planted, cultivated and cared for up to the time the first crop is harvested represents an outlay of about \$50 per acre, so that it is a crop that the poor and shiftless man cannot afford to grow.

Southern agriculture has its peculiar problems and the labor problem, so vexing to Northern agriculture, seems to be even more serious in the South. It is not only a labor problem, but it is a race problem that must be solved and only the future will reveal what the solution may be.

HOMER C. PRICE.

Truck Growing on the Coast of South Carolina.

Truck growing in this section has its advantages and disadvantages. The climate is good and some kind of crop can be grown all the year; so crops reach the market at a time when they are in demand. The labor, however, is inefficient and very scarce; all work being done by negroes, mostly by women and children. Methods of culture are different from those used in the North, nearly all the work being done by hand.

The freight rates to the Northern cities are high, so, in order to make a profit, the crops have to be sold at a price much higher than would be received for Northern grown products. Land is moderately fertile and is fairly easy to till, but it is necessary to have some thorough system of drainage, because all of the land is level and low-lying. Open ditches are used to drain off the surplus water. These ditches are expensive to keep up and a great deal of land is wasted by having a ditch two or three feet wide every fifty or seventy-five feet. Where land is expensive and intensive farming methods followed, this is quite an item.

No fruit is grown for market in the coastal region of South Carolina except a few strawberries. Nearly all kinds of vegetables are grown, however, and some crop is being shipped nearly all the year. Potatoes and cabbage are grown more extensively than any other vegetable, and in most cases are grown on a comparatively large scale.

Around Charleston there is grown in the neighborhood of 40,000 acres of cabbage and probably as many potatoes. The larger part of the area devoted to cabbage is controlled by a few men. There are, however, near Charleston, a number of truck growers who work with few areas and grow most all kinds of truck crops.

Cabbage and potatoes are grown as spring and early summer crops. The cabbage seed is sown in the open on raised beds, from the first to the tenth of October, and are not disturbed until about December 1, when they are ready to set out in the field. The land for cabbage is well plowed to a considerable depth, rows marked off and one ton of high grade (7-5-5) fertilizer is used per acre. After the fertilizer is

applied, two furrows are thrown together, forming a ridge on which the plants are set. The ridges are flattened on top by means of a roller, which has slats nailed on it to mark off the place for the plants. The crop is cultivated with cultivator and sweeps and some hand work is done. When growth begins during the latter part of February or March, a light dressing of sodium nitrate is applied to stimulate the growth.

Jersey Wakefield is the variety most in demand, but some Charleston Wakefield is planted. The heads of these varieties are small and pointed, but mature very early and rapidly. The difference of a few days in time, when they are ready for market, may mean the difference between profit and loss. As a rule, they begin to harvest the crop before the heads are fully matured or about April 1.

In harvesting the cabbage, a large knife is used to cut off the heads. A cart is driven through the field and the heads are thrown in as they are cut. From the field they are hauled to the packing shed and dumped on the ground and are trimmed, ready for packing. Women do most of the work of trimming and packing and the men nail up the crates and load them. All large plantations have a number of packing sheds with a spur track running to each of them. After the crates are nailed up they are loaded on cars and are not unloaded until they reach the market of Northern cities.

The crates are made of rough pine lumber, sawed, usually on the place and made there; size is 40x21x12, and are called barrel crates. Two hundred crates per acre is considered an average yield. The past year the average net price per crate was \$1.35 per crate, or an average of \$270 per acre profit.

The cost of growing an acre of cabbage is about \$75, and the freight to Northern cities—New York, Philadelphia and Boston—is 65 cents per crate.

One company near Charleston, S. C., grows from 700 to 800 acres of cabbage annually. The past season they sold 137,000 crates at a net price of \$1.35 per crate. Last fall they had about thirty-five acres in their seed bed and this season they sowed one ton of cabbage seed.

Potatoes are planted in February usually early in the month and are ready for market by the latter part of May or first of June. The company referred to grew 200 acres of potatoes the past season, yielding 96600 barrels, which sold for \$35,000. Fifty barrels of marketable potatoes per acre are considered a fair yield for early potatoes. They are dug by hand, using an ordinary spading or potato fork, are barreled in the field and are sorted into two grades.

After the truck crops are removed a crop of corn or cotton is usually planted on the large plantations, while on the small places, some other truck crop is planted. A very good crop of corn or cotton is produced after truck has been grown and a double profit is secured. During a good season and when the market is not over stocked, nothing pays better than truck growing, but is not as certain as a crop of cotton would be.

H. C. THOMPSON.

Annual Convention of the Association of American Agricultural Colleges and Experiment Stations

The Association of American Agricultural Colleges and Experiment Stations holds a meeting each year in November and delegates are present

from the agricultural colleges and experiment stations from each state in the United States.

This year the association met at Baton Rouge, the capitol of Louisiana and the place at which the State University is located. There were about 150 delegates and visitors present and the program was of unusual interest. The forenoon and evening programs were devoted to the general sessions of the association and the afternoon programs to the sections, of which there are two, one for college work and one for experiment station work.

It is under the auspices of this association that the graduate schools of agriculture have been held, standing committees are maintained on graduate study in agriculture, methods of teaching agriculture, agricultural extension, organization and investigation of agricultural experiment stations, and valuable reports are submitted by these committees each year and make up an important part of the proceedings of the association.

Invitations were received this year from Iowa and from Cornell for the next session of the Graduate School of Agriculture.

One afternoon the entire association went as the guests of the citizens of Baton Rouge to visit a sugarcane plantation five miles below the city and on the opposite side of the Mississippi river. The members of the association were received with proverbial Southern hospitality on every hand and were royally entertained.

A strong invitation was received to hold the next session of the association at Lansing, Mich., in connection with the celebration of the fiftieth anniversary of the founding of the Michigan Agricultural College, and it is probable that the invitation will be accepted.

The following officers were elected for the ensuing year: President, Dean L. H. Bailey, Cornell; secretary, Director John L. Hills, Vermont. Executive Committee — President H. C. White, Georgia; President J. L. Snyder, Michigan; President W. E. Stone, Indiana; Director W. H. Jordan, New York; Dean C. F. Curtiss, Iowa.

The officers elected for the sections were: College section — Chairman, President A. E. Bryan, Washington; secretary, Dean H. C. Price, Ohio. Experimental station section—Chairman, Director M. A. Scovell, Kentucky; secretary, Director C. E. Thorne, Ohio.

Wheat Growing in Kansas.

Burdett, Kansas, Nov. 10, 1906.

Although seeding in this section is about over, wheat will continue to be sown as late as the middle of December; and that such will produce a fair crop has been demonstrated time and again. In fact, I know of one case where wheat was drilled in on Christmas and this afterward gave a yield of twenty-two bushels per acre. While the early sown wheat as a rule gives better returns and farmers generally prefer September and October sowing, this year has, so far, proved an exception. The slow, procrastinating farmer has really been the better business man. During the early fall, and, in fact, until the last few weeks, there has been much complaint in different parts as to the ravages of the grasshoppers. But the cool, moist weather of a few weeks ago has given the young wheat a chance to get the start of the hoppers. The damage to the young plant is done early in its existence, just as it is coming through the ground. Therefore, if there are a few cool days with sufficient moisture to enable the plant

to get three or four blades above the ground, the hoppers will not materially damage it. That is, they will not injure it unless they come in greater numbers than I have so far seen them. There are thousands of acres that are being re-seeded for the above reason, but the damage done in this immediate section is slight. The writer has had some twenty-five or thirty acres to be redrilled out of a total of 350. In most cases the injured area, where the ground has been plowed, consists of a strip of two to four drill widths around the edge of the field, but, of course, this would vary in different localities. If the field is unplowed stubble and sown early, it is likely to have been more or less destroyed, but the stubble is likely to be the last sown, for the reason that the farmer generally plows until it begins to grow late; then drills what he has plowed and afterward drills in the stubble.

Another reason for the late seeding, aside from the grasshoppers, is that there have been several heavy rains since the fall work began, each lasting from one to three days, and this has caused a loss of two or three weeks. But farmers are not lamenting the idea of late seeding, for it has been many years since conditions were more favorable for a wheat crop, so far as the fall and early winter part of it is concerned. Older men at the business than myself say that there is enough moisture in the ground to carry the wheat safely over till late spring, should there be no more precipitation until that time. However this may be, one thing we are certain of, that the wheat will have developed an excellent root system and will go into the winter in the finest kind of shape.

At present, much of the wheat is large enough to afford good pasturage for

cattle and horses. The custom here is, as soon as the fall seeding is done, to turn out the horses on the first sown wheat, which, as a rule, will be ready for pasture at that time. It is also customary to rent the pasture at a dollar per head per month for horses, or 75 cents for cattle. This is clear gain to the farmer who rents out his field of wheat, but, in some years, is not the best thing for the young growing plant. However, take it one year with another, it is generally conceded among the farmers that pasturing does not materially injure the plant and especially is this true when they think of that dollar as pasture fee.

I mentioned a certain yield of twenty-two bushels per acre. Now I realize that that would not be counted much of a crop in Ohio, but when you take into consideration the expense account in that state, compared to this, twenty-two bushels is a very profitable yield. I believe I am safe in saying that the average farmer in this section can afford to raise wheat at a yield of ten bushels per acre. Let us look at the expense account: Plowing and drilling for one acre of ground, \$1.60; seed wheat, three-fourths bushel, 50 cents; harrowing, \$1.50; threshing, six cents per bushel or sixty cents; hauling to market, 50 cents. Total expense, \$4.70. Suppose the wheat sells for 60 cents per bushel or a total of \$6, there would be a surplus over and above the expense account of \$1.30 per acre, which is a very good rate of interest for the money invested.

Nitrogen in the Soil

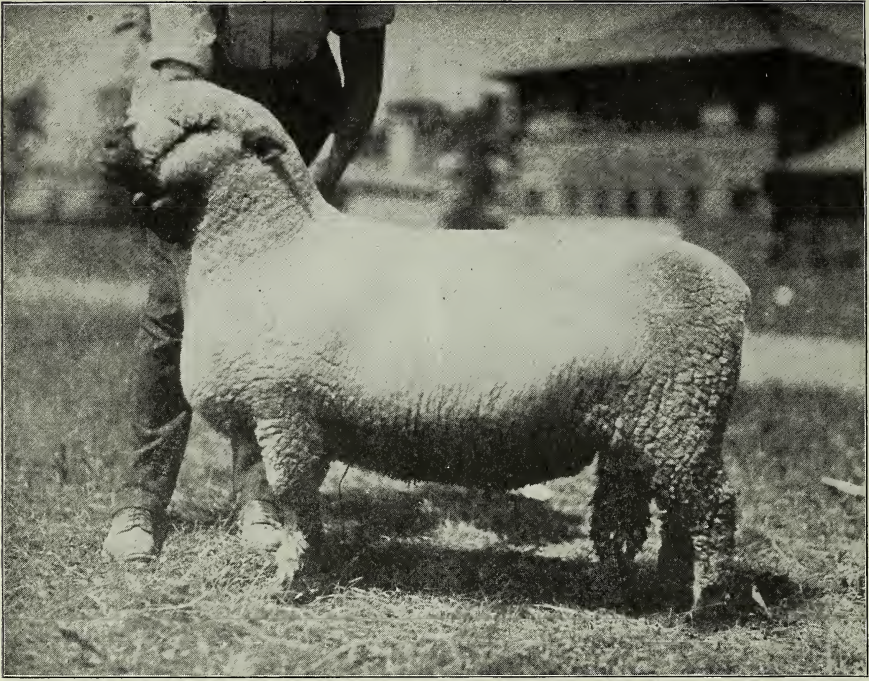
Nitrogen was discovered by the English chemist, Rutherford, in 1772. A little later Scheele showed it to be a constituent of air and Lavoiser gave it the name azote, signifying that it would

not support life. The name nitrogen was afterward given it because of its presence in saltpetre or nitre.

Nitrogen occurs in nature in the free state as a constituent (78 per cent.) of the air, in which form, however, it is not available for plant food. It also occurs in combination with other elements, as nitrates and various other compounds. And it is upon certain of these combined forms which are found in the soil that our plants must depend for their supply of nitrogen.

Nitrogen occurs in the soil in various forms, dependant largely upon the conditions and the source from which it is derived. As a part of the soil air it exists as free nitrogen, and is essential to the life of certain microscopic organisms, which seize upon it and render it available to higher plants. During different stages of this transformation it exists as ammonia and nitric acid, which are soon converted into nitric acid, and which in turn combine with the bases in soil to form various nitrates as KNO_3 , $\text{Ca}(\text{NO}_3)_2$ and others. But in this form Warrington states that the amount seldom reaches 5 per cent. of the total nitrogen content of the soil. The larger part of the nitrogen of the soil is stored in the form of humus, which, through fermentation, is gradually converted into nitric acid and thus rendered available as plant food. The roots of field crops and other vegetable matter contribute largely to the amount of organic matter in the soil, a part of which is converted into humus. The leguminous plants, however, contribute the largest amount of nitrogen to the soil.

The amount of nitrogen in the soil varies for different localities, but one observer states that it seldom falls below 1 per cent. in cultivated soils. At this figure he calculates that the sur-



A GOOD TYPE OF SHROPSHIRE RAM

face foot of one acre would contain about 3500 pounds of nitrogen, or enough for seventy crops of wheat of thirty bushels each. Other analyses of a number of soils in different places show results varying from .149 and .146 per cent. in England to .308 per cent. in Illinois and .341 per cent in Russia. This amount of nitrogen is not all contained in the surface foot of the soil, but is distributed to a depth of four or more feet. This, however, is not all in forms available for plant food, but by favorable conditions of tillage may be converted into available forms.

Nitrogen forms one of the essential constituents of cell protoplasm, and is also contained, to a considerable amount, in the proteids and albumens which are built up by the plant. A crop of wheat yielding thirty bushels

per acre requires 48 pounds of nitrogen; oats yielding sixty bushels per acre, requires 73.3 pounds of nitrogen, and clover yielding two tons per acre, requires 102 pounds of nitrogen.

After noting these large demands for nitrogen by the various crops, it will be well to consider briefly the sources of supply of nitrogen in the soil.

Small amounts, probably not to exceed eight pounds per acre a year, of the nitrogen in the soil are derived directly from the atmosphere in the form of nitric acid, which is brought down by the rain; but the greater part is derived from the more or less decayed matter left behind by plants previously produced. In this form the nitrogen is of no value to the plant. It must be transformed into soluble

nitrates. This process, by which the nitrogen is converted into available forms, is called nitrification.

For a great many years scientists and experimentors were at a loss to explain how the nitrates in the soil were formed, and it was only after more than a century of experimenting that the secret was discovered. It is now known that the formation of nitrates in the soil, from ammonia and other nitrogenous matter, is brought about by the action of certain microscopic organisms or bacteria. There are at least three kinds of bacteria necessary to carry out the entire process. The first acts upon the organic matter, forming ammonia; the second changes the ammonia into nitrites, and the third converts the nitrites into nitrates. The rapidity with which they carry on their work is influenced greatly by the temperature, the action being rather feeble at 40 degrees F. and ceasing entirely at 37 degrees to 39 degrees. They are quite active at 54 degrees, the activity increasing up to 98 degrees, but decreasing rapidly as the temperature rises above 100 degrees and ceasing again at 131 degrees. A certain amount of moisture is also necessary for their best growth, the amounts showing the best results varying from 5 to 15 per cent., no advantage seeming to be gained by the presence of more than that amount. In addition to water these bacteria must have food in the form of phosphates and other ash constituents. The nitrous ferments can feed on organic matter, but they can also live without it, forming nitrates from ammonia and carbonic acid, using the carbon for their growth and forming nitrates from the oxygen and the nitrogen of the ammonia. Oxygen is also necessary for their life processes, as is shown by the

fact that more nitrates are found in a loose aerated soil than in soils of greater compactness.

The nitrifying bacteria are killed easily by poisons, notably acids, chloroform, coal tar, the spent lime of gas works, ferrous sulphate or by the presence of a large quantity of saline matter; though as Schloessing and Muntz have shown that the presence of small quantities of saline matter does not hinder nitrification. It has been also found that small quantities of carbonate of lime, as well as a few of the alkalies aid nitrification.

These ferments have been found capable of forming nitrates from organic dust in the air, to be active in the disintegration of rocks, and, in some cases, to produce nitrates directly from the organic substances.

Putrification has been found to be adverse to nitrification, which takes place only during slow decay of organic matter in the presence of plenty of oxygen. When rapid putrification takes place ammonia is formed, which is later converted into nitrates. Nitrates are also formed to a certain degree in plants and by direct chemical reactions.

Opposed to the action of the nitrifying ferments, are certain denitrifying bacteria, which, under favorable conditions, seize upon the nitrate, reducing them into nitrites, and other forms acting similarly upon the nitrites and ammonia liberate the free nitrogen, thus rendering it unavailable as plant food. This process is accomplished, however, only in the absence of oxygen and in the presence of large amounts of organic and carbonaceous material. Thus it has been shown by numerous experiments that thorough cultivation checks the action of these forms and increases the activity of the nitrifying organisms.

A large amount of the nitrates are removed from the soil each year by the various forms of plant life. This is built up into complex compounds, as proteids and others, which, when the plant dies, pass back to the soil by the action of the nitrifying ferments. In other cases, where the plants are used for animal food, the proteids are decomposed and made to serve an important part in the life processes of the animal, the unused nitrogen eventually being returned to the soil in the form of urea and other organic compounds, which are, in turn, converted into nitrates by the process described above.

Besides the large amount of nitrogen removed from the soil each year by the various forms of plant life, there is another very appreciable amount removed by other means, which is a source of considerable loss to the farmer. How to prevent this loss of nitrogen is one of the most important problems with which the agriculturist has to deal at the present time. And another of equal importance is how to reclaim this lost nitrogen and bring it back to the soil.

There are four principal ways in which nitrogen is lost from the soil:

First. There is a large amount carried to the ocean in the form of dead animal and plant bodies, which fall into the streams. Again, large animals are taken to the cities as human food, very little of which ever finds its way back to the soil.

Second. By the process of denitrification a considerable amount of nitrogen is liberated into the air either as ammonia or free nitrogen gas.

Third. A considerable amount of soluble nitrates are dissolved by the rain water and carried away to the brooks and streams by the natural sur-

face drainage. This is one of the most constant sources of loss with which the farmer has to contend.

Fourth. Direct chemical decomposition by which an appreciable loss is sustained.

The next problem which presents itself for consideration is, how may this loss be offset and the nitrogen retained?

One of the first methods of reclaiming lost nitrogen is by fixation of free nitrogen from the air by certain micro-organisms. Numerous experiments have shown that the soil, even when destitute of all visible plant forms, will gradually increase in nitrates and total nitrogen content. This is now known to be due to the presence of these organisms in the soil.

There is also a second and more important means at the disposal of the farmer for increasing his store of nitrogen. This also is dependent upon bacteria and a peculiar relation existing between them and the family of leguminous plants. It has been proven by experiment that ordinary plants cannot use the free nitrogen of the air, but this rule does not hold good for the legumes, which were formed to be able to assimilate atmospheric nitrogen.

The question of the conditions under which such a question of atmospheric nitrogen occurs, was recognized to be one of the greatest importance. But after several years of investigation it was observed that the fixation of nitrogen by legumes is associated with the development upon the roots of little nodules known as tubercles. These tubercles are little swellings on the root, sometimes very numerous and varying from the size of a pinhead to that of a pea.

It was soon found that only such plants as developed these tubercles

were able to increase the amount of nitrogen in their tissue. It was also found that the tubercles were not found on the roots when plants were grown in sterilized soil. This and other experiments led to a careful examination of the tubercles, which were found to contain large numbers of micro-organisms; and it was found that when a sterilized soil was inoculated with bacteria from these tubercles, the plants grown developed tubercles on their roots.

The next question is, how are these tubercles produced by the bacteria? They are now believed to enter the root hairs. Within the root they find favorable conditions and multiply rapidly. Their presence in the root serves as a stimulus, which cause an abnormal growth about them, thus forming the tubercle. But the relation existing between this whole process and the assimilation of nitrogen is still a much disputed problem. There have been several theories offered in explanation of the phenomenon, but it is difficult to tell which is correct. In the first place, it is clear that an association between the legumes and the micro-organism is necessary for the fixation of nitrogen in the form of a nitrogen compound, but whether it is the legume or the bacteria or a combined action of both that causes the phenomenon is not so clear. One theory is that the bacteria themselves fix the nitrogen and that the legume simply furnishes a convenient and appropriate medium for their growth. A second theory is that the leguminous plant fixes the nitrogen through the agency of its leaves or roots, the bacilli in the roots serving

merely as a stimulus to increase the normal function of the plant. A third suggestion as to the phenomenon is that the fixation is a combined result of the organisms acting together. Still another theory is that the nitrogen has been fixed by other forms of bacteria in an insoluble form and that this compound is acted upon by the tubercle bacilli and rendered available to the legume.

It is impossible, at present, to determine which of these suggestions is correct. This much is certain, the legumes and bacteria together are able to fix the atmospheric nitrogen in quite large quantities, and that neither of them can do this alone under the ordinary conditions existing in the soil.

Some authorities believe that there are different species of bacteria for the different legumes, and others believe that they are the same species, but by continued association have adapted themselves to a particular plant. Thus we find that the legumes have become an important factor in the maintenance of soil fertility. In order to grow them successfully, one must use care to select the species best adapted to the particular soil at hand, and also to be sure that the soil contains the proper bacteria for that particular plant. This, however, can be best determined by actual experiment.

The nitrogen thus fixed may be utilized to advantage either by growing crop or by harvesting the crop and feeding it to the farm animals, thus returning a large part of the nitrogen to the soil in the form of barnyard manure.

M. D. MOORE.

The Dairies Near Cincinnati

The dairies located in the hills lying adjacent to Cincinnati are run on a principle quite different from the dairies in most other parts of the country. They are what might be termed milk factories, the dairymen being neither breeders nor farmers, but makers of milk. In a typical dairy here, all breeds of cattle are represented, with a very small percentage of the Channel Island breeds. No herd bull is kept. Cows with calves at their sides are bought in the stockyards at Cincinnati and driven home. In purchasing these cows their tendency to fatten rapidly, as well as the production of milk is considered. They are put on full feed as soon as possible. The calves are sold for veal and then the cows are milked until they "go dry." As the flow of milk decreases they begin putting on fat and by the time they have gone dry they are sold for beef. In this way the dairyman is constantly changing his stock, but he aims to keep the same number of cattle on hand all the time.

While the average size of the farms on which these dairies are located is nearly one hundred acres, very little feed is raised except timothy hay and blue grass. The greater part of the land is blue grass pasture. No wheat, a little corn and potatoes and some millet are raised. There are no silos and very little alfalfa is grown as yet. Antiquated methods of farming are practiced. Corn, when raised, is plowed with a one-horse bar-share plow. The soil which originally was good, had become impoverished by erosion and exhaustive cropping before the dairies were established. When the dairymen began they had to buy feed because their soil was too poor to produce it.

The by-products of the many distilleries and breweries, as well as the two

starch factories near Cincinnati, furnished an abundant supply of cheap cattle or hog food which was rich as a milk producer: the "still slop" from the distilleries, the barley grains from the breweries, and the starch feed and gluten or "starch slop" from the starch factory. The "still slop" and gluten were liquids, while the barley grains and starch feed were solids; they were also very heavy, due to their high percentage of water. It was no small task to get this feed from the factory to the dairy. One and often two four-horse loads are hauled every day during the winter. Fortunately the roads are macadamized, and are good the year round. In addition to these by-products used as feeds, other feed stuffs have to be bought—bran, hominy meal, cotton seed meal and corn meal as well as enormous quantities of clover hay. The clover hay is cut, mixed with the other feeds, and fed as chop feed, this being the only form of feed the cattle get. Corn and oats are bought to feed the horses, of which there are from eight to twenty. Usually sufficient timothy is raised to feed the horses, though not always.

There are from twenty to two hundred cattle in a dairy, the average number being about fifty. Naturally where so much live stock is kept, a large amount of manure will be produced. No grain is raised by the dairymen, hence there is no straw for bedding. The liquid and solid excrements fall in the gutter together, and become thoroughly mixed in shoveling out of the stable. Sometimes the manure is wheeled out and dumped off a platform onto a pile. In other places it is pushed out a chute, the stable being near an embankment or steep slope down which the manure flows. Some stables seem to have been built with the end in view of

getting rid of the manure as easily as possible. This manure is so plastic that it will spread out on level ground like an enormous pancake. If the place where the manure is dumped from the stable has any grade at all, the manure will find it and flow down it.

Of the immense quantities of manure made every winter in the dairies by far the larger portion of it goes to contaminate the streams, while usually only the small portion that has lodged behind some obstruction and dried up is applied to the soil on the potato patch or the timothy meadow. This is not true of all the dairies, but it is true of the greater number. Large yields of timothy are obtained from its use, and one would think that after seeing the results, it would be saved more carefully.

The dairymen say that the difficulty of getting help and the great amount of work that they have to do hauling feed, delivering milk, feeding and milking the cattle and cleaning the stables, makes it impossible for them to get time to haul out the manure, or do any farm work. They say further that work on the farm does not pay anyhow, and that alfalfa and ensilage make the milk ropy and they will not feed it. It seems to me, however, that if they would get a little extra help, cover their land well with manure, get some up-to-date farm implements, build a silo, start a patch of alfalfa, and keep their stable cleaner, they could discard their feed wagon and slop box and put more time on the soil, which would not only save the streams from contamination, but would bring the dairyman greater pleasure and profit as well. A Subscriber.

Experiment Station Notes

Director C. E. Thorne spent several weeks in the South attending the meeting of the Association of Agricultural

Colleges and Experiment Stations and several other important agricultural meetings.

J. W. Ames, chief of the chemistry department, attended the meeting of the American Association of Agricultural Chemists at Washington, D. C.

Professor A. D. Sebby has returned from Oklahoma much improved in health. He is spending the holidays at Washington and New York, attending the American Association for the Advancement of Science.

Bulletin 175 has just been issued from this department. It is entitled "A Second Weed Manual of Ohio," being a revision of Bulletin 83. It considers weed questions in general and contains a completely revised, descriptive and illustrated list of Ohio weeds.

C. G. Williams has been called to judge corn and lecture at several Farmers' Institutes during the past month. Professor Foord accompanied him upon some of these trips.

C. H. Kyle, of the agronomy department, has been collecting some very valuable data concerning alfalfa growing in Ohio, which will doubtless soon be published. The need of such information is quite evident among farmers and students generally.

Professor Greene is pushing the forestry work as fast as possible. He hopes to have visited all the plats by January. In selecting these plats that are proposed for planting this spring the station desires that the plantings will be such as to be an experiment that will help in proving or disproving some theory.

Generally speaking, the station force is quite busy summarizing the results of this season's work and preparing it for publication.

Alumni Notes

Garnett January, ex-'07, was married at Thanksgiving time. He has been engaged in farming and reports a successful season.

Elmer Cook, of the '04 class in the short course, is still working on the stock farm of Professor Mumford at Ann Arbor, Mich. During the summer, Mr. Cook made a trip up into Canada and took up a claim of 160 acres. He intends going there in the spring and to begin stock farming.

T. N. Gillespie, ex-'07, is farming at Beaver Falls, Pa. He is enjoying farm life. He reports that his barn was burned during early summer. Several cows perished and considerable machinery and feed were destroyed.

William Walker, ex-'04, is operating his father's farm and is superintendent of the schools in Brown township of Franklin county.

William Pew, '06, of Iowa, formerly of Ohio State, had charge of the university exhibit of swine at the International.

H. C. Crall, ex-'07, is farming at Bucyrus, Ohio. He is making some very interesting feeding experiments with swine. He is lecturer of their home grange and manager of a home reading course in agriculture. Mr. Crall is a pusher and is winning the admiration of all the farmers in his vicinity.

Messrs. Minns and Bowser are employed on the Chestnut Hill farm, near Youngstown. Mr. Minns is farm superintendent and Mr. Bowser is at the head of the creamery. They are building up a dairy herd of Guernsey cattle.

C. L. Miner is assistant foreman on a large ranch in Mexico. They are

sowing a large area of alfalfa. This section of the country is watered by irrigation. We hope to hear more about this kind of farming in the future.

Emmett Irvin Lichti, '06, H. and F., is assistant in vegetable pathology in the Agricultural College, Md.

Robert A. Young, '06, H. and F., is assistant in Botany at O. S. U.

William F. Watt, ex-'08, is at home on his farm near Xenia, breeding Cottswold sheep and Duroc swine.

Leonard Hill, ex-'07, has left school to work at home on the farm near Piqua, Ohio.

Frank Rarey, ex-'09, is farming with his father near Kenton, Ohio.

Gabrael F. Correa, ex-'07, is employed by the Peruna Company and is faking work in ceramics at O. S. U.

There are seventy registrations for the ten weeks course already reported. Let the good work go on.

Harvey Smith, who was in school last year, visited the university a short time ago. On account of his father's illness he has been home shipping potatoes from Wooster. He will enter school again soon.

Ward Briggs, Agr. S., who is well known to Ag. students, is now at home working on a dairy farm at Sleason Center.

A. B. Season, ex-'07, is located near Cuyahoga Falls, running a dairy farm.

Thomas Wheeler, '04, reporter for the Daily Drivers' Journal of Chicago, says that he is delighted with the work. He intends to be in Columbus during the meeting of the American Breeders' Association.

Eugene Wampler, ex-'01, is engaged in stock farming near Dayton.

W. T. Miller, ex-'07, has charge of his father's farm. He reports splendid crops, his corn being especially heavy.

A. G. Abbott, '99, owns a fine farm. He is engaged in stock raising. He recently completed a large silo. The college is proud of these men that are making a success upon the farm.

Arthur Strong, a short course man, is running a grain farm near Strongsville, Ohio. His yields of grain were the best in that vicinity.

Albert Burgess, ex-'07, is visiting in Ohio. He has been working at Iowa Experiment Station.

Frank Ruhlen, '96, former superintendent of the university farm, is farming near Plain City, Madison county.

Ellis Grooves, ex-'04, is farming in Belmont county.

Walter Florence, ex-'07, is managing one of his father's farms near Plain City.

Book Reviews.

THE BOOK OF ALFALFA. History, cultivation and merits. Its uses as a forage and fertilizer. By F. D. Coburn, secretary Kansas department of agriculture. Profusely illustrated with many full page plates of fine, clear photographs. 350 pages. 6½x9 inches. Cloth. Price 2. Orange Judd Company, New York.

The appearance of F. D. Coburn's little book on alfalfa, a few years since, has been a complete revelation to thousands of farmers throughout the country and the increasing demand for still more information on the subject has induced the author to prepare the present volume, which is, by far, the most authoritative, complete and valu-

able work on this forage crop ever published.

One of the most important movements which has occurred in American agriculture is the general introduction of alfalfa as a hay and pasture crop. While formerly it was considered that alfalfa could be grown profitably only in the irrigation sections of the country, the acreage devoted to this crop is rapidly increasing everywhere. Recent experiments have shown that alfalfa has a much wider usefulness than has hitherto been supposed, and good crops are now grown in almost every state. No forage plant has ever been introduced and successfully cultivated in the United States possessed of the general excellence of alfalfa.

The treatment of the whole subject is in the author's usual clear and admirable style, as will be seen from the following condensed table of contents: History, Description, Varieties and Habits; Universality of Alfalfa; Yields, and Comparisons with Other Crops; Seed and Seed Selection; Soil and Seeding; Cultivation; Harvesting; Storing; Pasturing and Soiling; Alfalfa as a Feed Stuff; Alfalfa in Beef-Making; Alfalfa and the Dairy; Alfalfa for Swine; Alfalfa for Horses and Mules; Alfalfa for Sheep-Raising; Alfalfa for Bees; Alfalfa for Poultry; Alfalfa for Food Preparation; Alfalfa for Town and City; Alfalfa for Crop Rotation; Nitro-Culture; Alfalfa as a Commercial Factor; The Enemies of Alfalfa; Difficulties and Discouragements; Alfalfa in the Orchard; Practical Experiences with Alfalfa.

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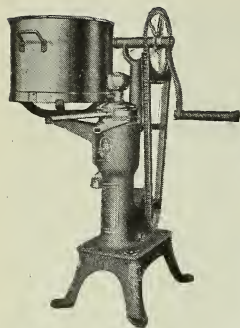
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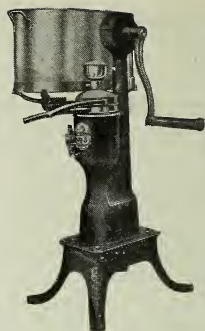
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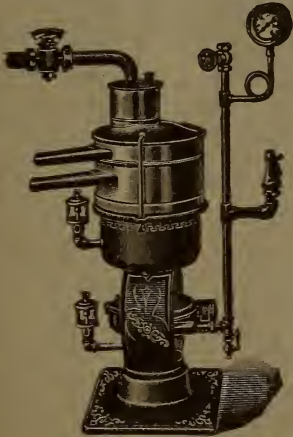
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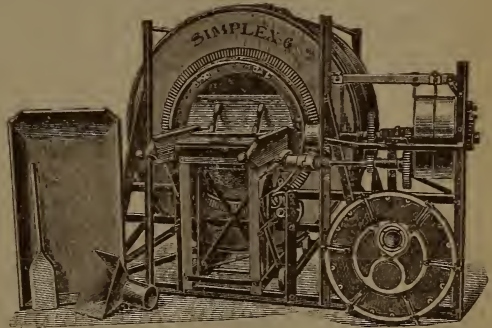
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